

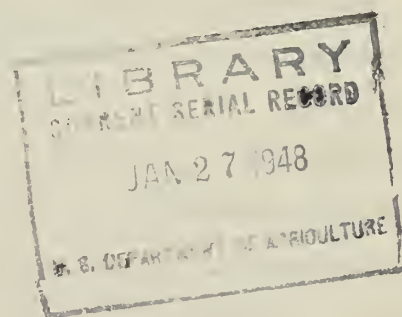
Historic, Archive Document

Do not assume content reflects current
scientific knowledge, policies, or practices.

Ag 84 Pro
Cap 3

Rat Control Methods

Prepared by
U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
In cooperation with
U.S. DEPARTMENT OF AGRICULTURE



Washington, D. C.

1948

CONTENTS

	Page
Destruction of Rats	1
Poisoning	1
Types of poisons	2
Red squill	2
ANTU	2
Zinc phosphide	2
Sodium fluoroacetate (compound ten-eighty)	3
Thallium sulphate	3
Bait preparation	3
Bait placements	4
Prebaiting for rats	5
Gassing	6
Trapping	7
Other methods	8
Harborage removal	8
Ratproofing	8
General sanitation	9
Organizational methods	10
Mouse control	10

UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

January 1948

RAT CONTROL METHODS

Modern rat control methods are less a matter of startling new techniques than thorough application of all principles involved. Simply destroying a few rats here and there does not begin to solve the problem. Mankind has been killing rats for centuries without halting the spread of these obnoxious pests.

Fortunately, we are becoming more conscious of the deadly effect that rats have upon our every day existence. In thus becoming more rat conscious, we have an ever-increasing possibility of gaining the upper hand over one of the greatest spreaders of disease, death, and destruction the world has ever known.

Permanent control is the only satisfactory solution to the rat control problem. Sporadic campaigns to destroy rats, although often successful in reducing the numbers for a short period, must be repeated again and again, with little likelihood of achieving long-lasting results. Any program, to be successful, must incorporate these four major phases of control:

1. Destruction of rats.
2. Elimination of harborage.
3. Elimination of food supply.
4. Ratproofing of buildings.

Furthermore, this program should receive attention at all times of the year. Once initial success has been obtained, maintenance is essential or conditions will soon revert to their former status. The only successful program is a permanent one, involving drastic reduction of rats and conditions favoring them, as well as a constant watch to repel new invaders as fast as they appear. Complete and wholehearted cooperation of all concerned, private and public, is the keystone to a successful program.

DESTRUCTION OF RATS

A. Poisoning.

The most efficient means of causing wholesale destruction of rats is through the use of poisons, or rodenticides, as they are known. However, poisons that are deadly for one warm-blooded animal are also more or less poisonous to others. Human beings, pets, and domestic animals must be protected against accidental poisoning. Care must be taken while handling the

materials and every precaution taken to avoid contaminating foodstuffs. Select, then, the poison that best fits the conditions under which it is to be used.

1. Types of Poisons.

a. Poisons for General Usage. These materials can be used by the average person without difficulty, providing proper precautions and instructions are followed at all times.

Red Squill. Red Squill is obtained from a lily-like bulb grown in the Mediterranean region. It has the peculiar advantage over other poisons of containing an emetic agent which causes most animals other than rats to vomit, thereby ridding themselves of the material. It has, furthermore, a disagreeable taste, so that many animals will not touch it. Nevertheless, it is a poison and should be treated as such. Red squill, as imported, lacks uniform toxicity, and often may be an unreliable rat poison unless it has been brought up to uniform strength by an extraction process. Purchasers should insist upon red squill with a guaranteed minimum toxicity not to exceed 500 mg/kg. Best results are obtained when mixed with bait materials in a one to nine proportion; that is, 10 percent of the bait. When mixing with a cereal base, add squill to the dry mixture and stir thoroughly before adding water. With meat or fish, make a thin paste with squill and water, being careful to avoid lumping, then blend with the bait.

ANTU. This is the abbreviated name for the chemical alphanaphthylthiourea. It is quite toxic to the common brown, or Norway rat, much less so to black and other forms of climbing rats. For this reason it is not recommended for general use in areas, such as the Southern States, where the climbing rats predominate. Dogs and other pets, pigs and day-old chicks are also killed easily by ANTU. Although many other domestic animals are more resistant to this poison, all precautions should be adopted to prevent its contact with children, pets, domestic animals, or foodstuffs. ANTU is a grayish-white powder, insoluble in water, chemically stable, and nonirritating to the human skin. It kills by causing an accumulation of body fluids within the chest cavity, literally drowning the rat. Most effective results are obtained when used in food baits in a concentration of 1-1/2 percent. It is essential that a complete coverage be made when baiting with ANTU. Rats taking less than a lethal dose build up a tolerance as well as a strong dislike for the material. Operations with ANTU should not be conducted at intervals of less than 4 to 6 weeks. Hence, in a permanent control program in which ANTU is used, it should be alternated with some other effective rodenticide.

Zinc phosphide. This material is highly toxic to all forms of animal life, and great care must be exercised in its use. It

is a dark, gray powder, insoluble in water, with a strong pungent odor characteristic of phosphorous compounds. Although well accepted by rats, this odor is, to some extent, unattractive to some animals. It deteriorates rather rapidly, so that baits are relatively nontoxic after several days exposure to the open air. For longer lasting effects, the baits should be wrapped. Since fats and oils increase the absorption of phosphorous in the body, baits of these materials give best results. A small amount of bacon fat or mineral oil added to the bait mixture will usually work satisfactorily, as well as make it easier to blend the mixture. Use a 1-percent concentration of zinc phosphide in baits. A number of deaths have occurred from misuse of phosphorous poisons. In view of the hazards involved, the use of other types of phosphorous compounds and mixtures of the pure element are not encouraged.

b. Poisons for Special Uses. These poisons consist of highly toxic substances that are extremely dangerous to all forms of animal life. They should be used only by trained professional operators.

Sodium fluoroacetate (Compound ten-eighty). This material is not sold on the open market. Its use is restricted to insured pest control operators and to qualified Government technicians. There is no antidote. It is so toxic that merely one-half ounce is mixed in a gallon of water to make a drinking bait. A single sip of this preparation will kill a rat. Furthermore, the poison does not disintegrate upon being swallowed. A cat or dog eating dead or dying rats will also be killed. Because of this danger of secondary poisoning, compound ten-eighty should not be exposed indiscriminately out of doors or in places where pets or domestic animals are kept. Use of this material, except by trained individuals, is not recommended.

Thallium sulphate. This is another deadly substance not recommended for general usage. Although not quite as toxic as compound ten-eighty, it is tasteless and readily accepted by rats. It possesses all of the hazards of ten-eighty, plus the fact that it is cumulative and also is capable of being absorbed through the skin. Operators handling thallium should always wear gloves, and its use should be restricted to trained technicians.

2. Bait Preparation.

Rats are omniverous, that is, they will eat almost any type of food available. Like humans, individual rats have definite food preferences which must be catered to. Generally speaking, however, bait materials fall into the main classes of cereals, meats, fish, cheeses, fruits, and vegetables. Any or all may be acceptable at any given time. Often a change in diet offered will provide the greatest success. If the rats have been eating poultry feed, bait of meat or fish base may produce the best results.

On the other hand, rats occasionally will refuse to touch a food they are not used to eating. More important than the actual bait materials used is the employment of proper techniques in preparation. Too much poison in the mixture is just as ineffective as too little, for acceptance will be cut down. If not thoroughly mixed, some portions of the bait will have too strong a concentration, while other parts will be too weak to produce results. Small lots, up to a pound or two, can be mixed readily by hand, by using a mixing bowl, pail, or similar container and a large spoon or paddle. Articles used for mixing poisons should be used for that purpose only, and kept separate from all other utensils. They should be labeled "POISON". Larger lots are more easily mixed mechanically. A table model electric mixer will handle up to about 10 pounds of bait materials at a time; floor models will mix 50 pounds with ease. Mechanical mixing saves labor and results in a more uniform mix than by hand methods. Mix only enough for use the same day or within a 24-hour period. Baits are most acceptable when fresh; therefore, do not make up a week's supply at one time. Weigh the ingredients carefully to insure the proper proportions. Do not guess.

3. Bait Placements.

The proper placement of the material is more important than the type of bait used. Rats seek shelter and protection in their movements. Baits placed in travel ways and harborages are far more likely to be found and sampled than those exposed in the open. Proper placement is important from the safety standpoint, too, if children, pets, and domestic animals are to be protected from exposure to the poisons. So, bait should be placed under cover whenever possible. An old board or a box can be leaned against a barn wall, covering a runway. Bait stations, consisting of an inverted box with a 2-by 3-inch hole cut in each end, can be used as permanent exposure stations. This has the added attraction of offering harborage when trash piles or other old rat shelters are cleaned up. In any event, place baits where rats are, and where they are moving. Do not expect them to come to you. Of equal importance is the distribution of enough bait. Put out more than you deem necessary. Baits should be made into a small ball about the size of a walnut or marble. Do not worry about the odor of your hands. Rats are as familiar with human scent as any other odor. Sometimes it may be desirable to wrap the baits in a small piece of tissue or waxed paper by simply cutting a 4-inch square, folding it over and twisting the ends. This helps some baits remain fresh over a longer period. Also, it provides a convenient means of handling dry bait mixtures, as well as an added safety factor for the protection of other animals. The main objection to this method is that rats will often carry the torpedoes, as they are called, back to their nests, but not eat them. When it is essential that baits not be carried away, use a dry mixture,

such as corn meal or a feed mixture, placing it in a shallow tray beneath a bait station.

4. Prebaiting for Rats.

The most satisfactory results from poisoning operations are obtained when areas to be treated are prebaited. This consists of exposing fresh, unpoisoned bait materials, prepared exactly as poisoned baits will be later. Prebaiting will indicate which focus will be most readily accepted, where baits will best be taken, and how much material will be consumed at a feeding. Often it will provide a satisfactory solution to stubborn cases, or when previous poisonings have been unsuccessful. It is simple, and the extra time thus spent is worth-while.

Remove all sources of food for rats insofar as possible, paying particular attention to such items as garbage cans, stored foods, grain bins, and exposed crates of fruit and vegetables. Do not remove trash, piled materials, or other nonfood items until after the baiting is completed. Do not block runways or burrows, as this might arouse the suspicion of the rats or cause them to move.

Use at least three kinds of food baits, preferably giving a choice of moist and dry foods. The following classes, most of which can be obtained from ordinary kitchen scraps, are suggested:

Meat: Ground lean beef, beef melts, liver, sausage, bacon, chicken entrails, or canned meat.

Fish: Fresh ground raw fish; canned fish, or cat food.

Cereal: Bread crumbs, rolled oats, corn meal, chicken mash.

Vegetables: Sliced tomato, green corn, carrots, or lettuce.

Fruits: Cantaloup, watermelon, banana, or apple.

Other: Peanut butter, sweet chocolate, dried milk, or raw eggs.

Expose the different types of bait to be tested in teaspoonful quantities side by side in all spots where rats may be likely to feed upon them. Place baits in the late afternoon or early evening, treating the entire area to be covered. Protect the baits from interference by cats, dogs, or other influences. Ob-

serve the results the following morning, noting the most acceptable bait, locations where the bait was taken, and the amount of the bait consumed. The exact locations of the most favored baits should be noted carefully, as it is there that the poisoned baits should be placed later. Remove all uneaten baits. If no baits should be taken readily, skip two nights and repeat with other baits until an attractive one is found.

B. Gassing

Control of rats by means of poisonous gasses falls into two main categories: Fumigation of buildings and structures, and gassing of burrows.

Building fumigation requires considerable preparation and special techniques. It should be attempted only by trained personnel, and in many areas is controlled by local regulations. In view of the many hazards and complications involved, its use in rat control is not generally recommended.

Gassing of rat burrows outdoors is an excellent means of control. Many rats are destroyed underground so that there is no problem of disposal of carcasses. Gas has the advantage over poisons of destroying the flea and mite parasites as well--a factor of considerable importance in controlling the spread of some diseases. The most commonly used gas for this purpose is calcium cyanide, in a dust or finely powdered form. It is simply distributed by means of a foot or stirrup pump, designed particularly for this purpose. The nozzle of the hose is inserted in the burrow, the rest of the opening sealed with earth, and five or six strokes of the pump handle provides the initial distribution. If gas is seen escaping from other holes, these too should be sealed, or the rats will escape. The valve on the bottom of the pump is then switched over to "air" and the gas is forced through the entire burrow system.

Burrows that have been gassed should always be broken up with a pick or shovel the next day and the earth tamped down tightly. Remaining rats will re-open burrows and can thus be detected and re-treated until all activity ceases. Do not use this method to treat burrows in dirt-floored basements or alongside foundation walls where entrance to houses is gained.

Cyanide is a deadly poison and should be used outdoors where it is quickly dissipated in the open air. Avoid breathing the fumes. Always pump air through the hose before storing it. The use of cyanide should be curtailed during freezing or rainy weather.

Carbon monoxide, introduced into rat burrows by means of a hose attached to the exhaust of a gasoline motor, also has been used with a fair degree of success. About five minutes running time per burrow will usually suffice. Since carbon monoxide is not as swift acting as cyanide it takes more gas and longer time to take effect.

Carbon dioxide, in the form of dry ice, has been found useful in fumigating refrigerated warehouses where low temperatures must be maintained

to prevent food spoilage. The ice is crushed and distributed through the room. An electric fan will speed up the dispersal of the gas. It is used at the rate of about 15 percent concentration, or 30 pounds per 1,000 cubic feet of space, for 24-hour exposure. Carbon dioxide has the advantage of being much safer to handle than the highly toxic forms of gas.

Other types of poisonous gasses are not recommended for general use in rat control.

C. Trapping.

In trapping, proper placement is far more important than the selection of a bait. Rats follow natural runways as far as possible, running along walls and stacked materials, rather than cutting across the middle of the room in the open. Their instinct for stealth and desire for protection cause them to pass behind anything set or leaning against a wall. The best baited trap will rarely entice a rat into the middle of the room. On the other hand, a rat will frequently pass over a trap rather than detour wide into the open.

Despite its reputation, cheese is not an infallible bait. Bacon strips, a piece of fresh fish, or bacon-scented oatmeal is better. Such baits should be tied firmly to the trigger to prevent their being stolen without springing the trap. Do not allow dead rats to decay in the trap. If this should happen, scald the trap before re-using, but do not worry about human or rat odors on the trap. A freshly killed rat in a trap will not frighten other rats away; frequently live rats will feed upon it. Nor is it necessary to throw a trap away once a rat has been caught. If blood or entrails are stuck on the trap, scrape them off before using it again.

The longer a trap is in use, the more likely a rat is to approach it.

Baited traps are not always necessary. Enlarge the trigger surface of an ordinary snap trap with a square of cardboard or a piece of tin, thus making the entire trigger half of the trap a treadle (fig. 1). A square of corrugated paper, with the trigger forced between the two layers of paper, will also serve. If desirable, a smear of bait can be rubbed on the surface.

Traps with the enlarged trigger surfaces should be placed in such a manner as to force the rats to cross over them, blocking a runway behind a box, a beam, or a ledge used as a runway (figs. 2, 3, and 4). When laying flat on a surface, straw or shredded paper in a thin layer can be used to mask the trap. By using a hose clamp, with a long bolt projection, a trap can be fitted to a pipe by drilling a hole through the trap and fitting it over the projecting bolt (fig. 5). Essential to success is the need for sufficient traps. Do not expect to catch 5 rats with 1 trap. As with bait, put out considerably more than seems necessary.

D. Other Methods of Destroying Rats,

Many other methods and techniques for killing rats have been advocated, but the three general methods previously discussed provide the most satisfactory results. For the most part other means of destruction either are rarely as efficient, or must be relegated to the role of superstition and folklore. Shooting rats, while sometimes an amusing sport, will not provide control of an entire population. Small terrier dogs and, rarely, cats, will kill occasional rats that they find, but cannot rid a premise of the pests. Ferrets, also, have been used to kill rats, but are too unreliable and destroy too few rats to be a practical control factor. Natural enemies, such as hawks, owls, and snakes, should be encouraged rather than destroyed, but they cannot be relied upon to do the whole job. Repellents of many types have been suggested, but since they dissipate rapidly, their use is limited to small confined spaces, and even there they must be replenished constantly. Furthermore, they accomplish no decrease in the population. Glue boards, based on the same principle as fly-paper, have been prepared, but for the most part they are far too messy. Rats soon learn to avoid them.

Virus diseases, supposedly capable of starting an epidemic among rat populations, have attracted some interest, chiefly because of the spectacular nature of the method. Those prepared, however, have rarely proved effective. Rats killed by the infected food had to be eaten by another rat to pass on the disease. Furthermore, the bacteria used belong to the same group as the food-poisoning bacilli and are known to have caused some human deaths. Some localities have prohibited the sale or use of the so-called rat viruses. For these reasons, they are not recommended.

In the realm of fantasy belong such devices as belling and singeing. Besides being needlessly cruel and foolish, they accomplish little. Plaster of paris offered with convenient dishes of water, is supposed to be eaten, then harden inside the rat. Ground glass, added to the diet, is supposed to carve up the intestinal tract. And broken glass in runways and burrows is supposed to lacerate their legs and body so that the rats bleed to death or are killed by other rats which are attracted by the flowing blood. Needless to say, all these methods are impractical.

Ever since the legend of the Pied Piper, mankind has been searching for some easy way out of rat trouble. When it is realized that good, hard work is the only answer, adequate control will then be obtained.

HARBORAGE REMOVAL

Unless the places where rats live are destroyed, and potential habitations are broken up, control methods are rarely successful. Rats can always find enough food available to sustain life. As long as a place to hide and rear their young exists, they will continue to survive. Studies have shown that, after a poisoning campaign, the rat population will return to its former size within 9 months--or less--if permanent control is not undertaken.

The common brown rat lives underground, beneath stored materials, behind double walls, and in other enclosed spaces. After a thorough poisoning program, these harborages must be eliminated as much as possible. All burrows should be broken up. Stored materials should be placed on racks 12 to 18 inches off the ground. If the woodpile is already stacked for the winter, plan now to build racks for it and place new supplies off the ground. Piles of rubbish and discarded material should never be allowed to accumulate. If materials are stored in a dirt-floored shed, they should be kept neatly, not piled on the floor. If they are worth keeping, they are worth proper storage care. Build shelves and racks to hold them. Double walls, made of wall board or other insulating material, are favorite harbors for rats. Eliminate them entirely. If insulation is needed, nail the insulating board directly to the wall between the studding.

Removal of these breeding spots not only deprives remaining rats of a place to live, but renders the place unattractive to new rats that may stray in.

RATPROOFING

Once the bulk of the rat population has been destroyed, and their harborages eliminated, it becomes necessary to make the buildings as rat-proof as possible in order to prevent reinfestation. Cement, 1/4-inch or 1/2-inch hardware cloth, and sheet metal of 26 gage or heavier, are all good ratproofing materials. Survey carefully the exterior of the building. All openings larger than 1/2-inch must be closed if rats are to be kept out. Wooden sills and doors at ground level must be sheathed in sheet metal to prevent gnawing. Windows less than 4 feet off the ground, where brown rats are present, and at any height where the climbing rats are prevalent, must be screened with hardware cloth. Foundation walls, particularly where utility lines enter the building, should be checked for openings and pointed up with cement.

When rats are burrowing beneath a foundation to enter a building, install a curtain wall, in the shape of an "L", 2 feet deep and 1 foot across the footing. Rats will tunnel down 3 or even 4 feet, but rarely will cut around the footing. Almost any structure can be made ratproof with a little ingenuity, and at the same time will provide useful and worth-while repairs to the building itself. When there are open buildings, such as barns and sheds, it is largely a matter of making certain that no haborage is present. Then, if a rat does run through the place, he will have no place to hide.

GENERAL SANITATION

Food and shelter are the two most important factors in a rat's existence. It hunts for food supply and for convenient haborage nearby. Eliminate these two attractions and any premise loses its appeal to rats. Ignore them, and new invaders will appear as fast as the old ones are killed off, particularly if nearby areas are undergoing a control program.

Eliminate completely open garbage and trash heaps. Avoid spilling food on the ground and leaving it for rats. If birds are being fed, use a ratproof feeding tray, with a generous ledge to prevent spillage. In cities, particularly, more food often goes to rats than to the birds. Get rid of unsightly dumps. If complete burning is not possible, bury the debris at least 3 feet deep and compact the earth around it. Let every week be an individual "Clean-up" week.

ORGANIZATIONAL METHODS

The degree of success attained in any rodent control program is directly proportional to the extent of participation by all concerned. From a practical standpoint, it is almost useless to attempt control on one premise if the adjoining properties go unchecked. The use of all available organizations and voluntary groups of individuals for spreading information and encouraging participation is essential. Damage and disease caused by rats should be made clear. Many people harboring rats are completely unaware of the cost of maintaining them.

Every effort should be made to have the program a continuous one and to obtain wholehearted cooperation. For additional information, consult U. S. Department of the Interior, Conservation Bulletin No. 8, "Rat Control", and Conservation Bulletin No. 19, "Ratproofing Buildings and Premises".

MOUSE CONTROL

In general, mouse control is based on the same techniques used for rats. But unless the infestation is heavy, trapping will often solve the problem. Of the poisons listed, ANTU and squill give poor results. Zinc phosphide and strychnine alkaloid are more satisfactory. Again, emphasis must be placed on proper handling of the materials, use of sufficient quantity of materials to insure results, and improvement of the over-all sanitation to eliminate conditions that permit these pests to exist. For additional information, consult U. S. Department of the Interior, Conservation Bulletin No. 35, "Control of Destructive Mice".

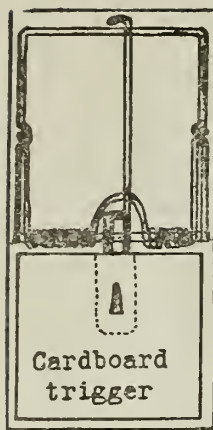


Fig. 1

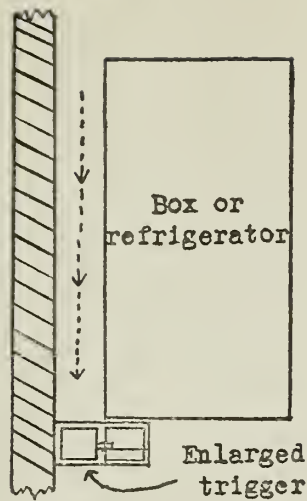


Fig. 2

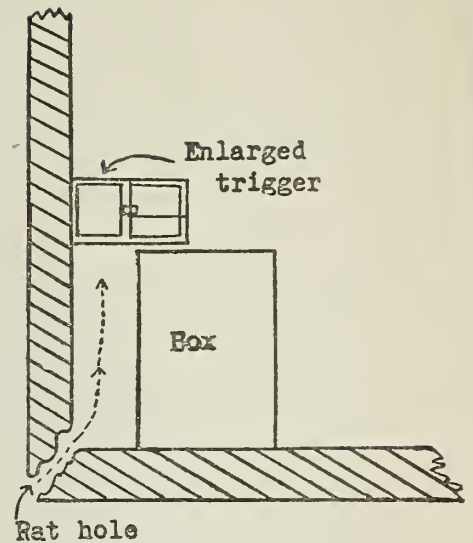


Fig. 3

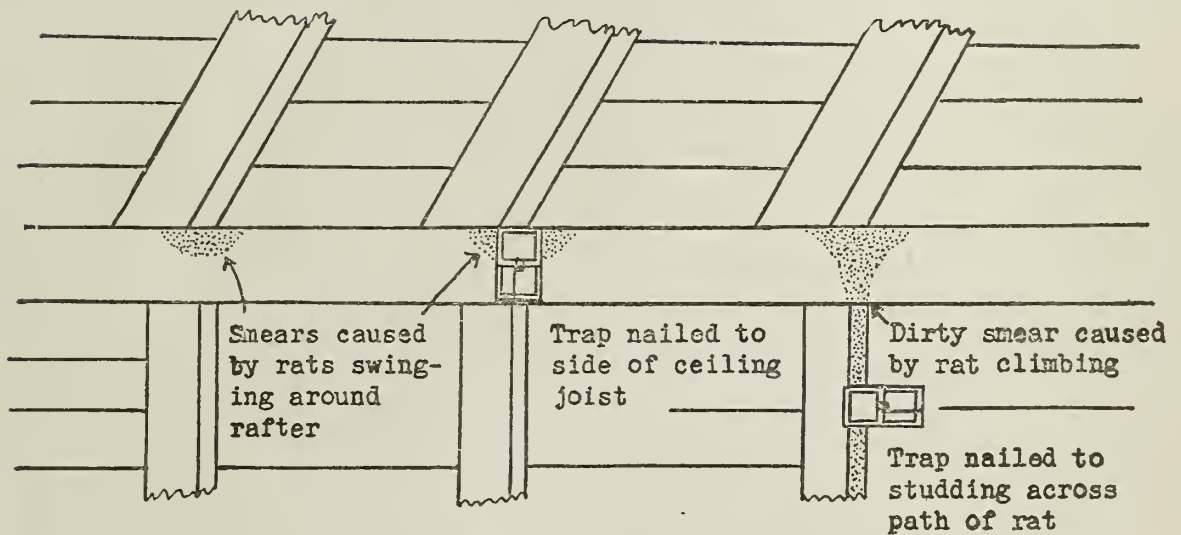
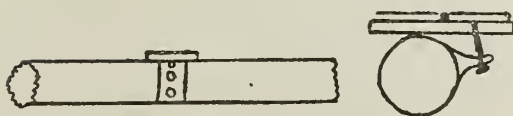


Fig. 4



Trap set on pipe by means of hose clamp with long bolt

Fig. 5

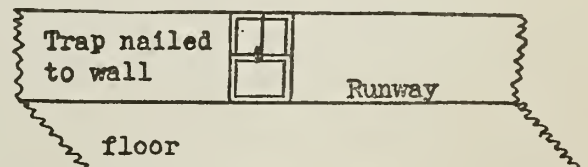


Fig. 6

Suggestions for setting rat traps.

